

Dating Popcorn

The logo for the Association of American State Geologists (AASG) features the letters "AASG" in a large, bold, serif font.

Association of American State Geologists

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How do geologists understand the Earth's history? In part, they measure the age of rocks and other natural materials by dating techniques. They can date rocks by gauging the amount of decay of radioactive elements. The time necessary for half of any given amount of one element (the "parent element") to decay to become another element (the "daughter element") is called the element's "half-life."

Ice cores, for example, contain data about Earth's past climate. Geologists use a dating technique called K-Ar geochronology to find the age of layers of volcanic ash in ice cores. The half-life of K-Ar is 1.25 billion years. By measuring the ratio of K to Ar in feldspar crystals in volcanic ash, geologists can determine the time of the eruption and, thus, the age of ice in which the ash is found. Once they determine the age of a volcanic ash layer, geologists can study the materials in that ice core layer for clues about climate conditions at that time.

You can simulate the dating process with popcorn. Popcorn starts out as unpopped "parent" kernels. Heating causes the kernels to begin popping, thereby starting your simulated "radioactive decay clock" and producing popped "daughter" popcorns. The half-life of your kernel-popcorn material is the time necessary for half of the given kernels to become popcorns.

Materials

- 6 mini bags of microwave popcorn, one for each group of students
- microwave (preferably with digital timer displaying seconds)
- stopwatch (only if microwave timer does not display seconds)
- sheet of paper and pen for each student

Procedure

1. Your group will be assigned to one "microwave popping time": 10 seconds, 20 seconds, 30 seconds, 40 seconds, 50 seconds, and 60 seconds. Label your popcorn bag with your group's time
2. When it is your group's turn, place your bag in the microwave, set the timer for 2 minutes, and begin cooking the kernels. Once you hear the first sound of popping, use the microwave timer or a stopwatch to count off the number of seconds written on your bag, then turn the microwave off and remove your bag.
3. Now open your bag. Count the number of unpopped kernels and the number of popped popcorns in the bag. Record these numbers.
4. Next, calculate the percentage of both unpopped kernels and popped popcorns in your bag. To do this, first divide the number of unpopped (parent element) kernels by the total number of kernels and popcorns in the bag. Next divide the number of popped (daughter element) kernels by the total number of kernels and popcorns. Multiply both fractions by 100.

5. Using everyone's data, draw a graph. Let the horizontal axis represent time, from 0 to 60 seconds. Let the vertical axis represent the percentage of material in each group's bag.
6. First, plot the curve of percentages of unpopped kernels in all bags. This curve shows the "decay" of "parent" unpopped kernels over time. Next, plot percentages of popped popcorns in each bag. As the percentage of "parent" kernels gets smaller over time, what happens to the percentage of "daughter" popcorns?
7. The two curves should intersect on your graph at the 50 percent point on the vertical axis. What is the corresponding point on the horizontal axis, which represents time? This is the half-life of your kernel-popcorn material."
8. Examine your graph. What would an ice core containing layers of kernel-popcorn material tell you about the age of other materials in that core? What would be the age of a layer containing 20 percent popped popcorn? What would be the age of a layer containing 80 percent popped popcorn?

For more, go to <http://geoinfo.nmt.edu/education/exercises>.